Refine Search

Search Results -

Term	Documents
QUALITY	465014
QUALITIES	66292
QUALITYS	1
OF	133538
OFS	442
BANDWIDTH$	0
BANDWIDTH	99574
BANDWIDTHALLOCATED	1
BANDWIDTHBJ	1
BANDWIDTHCHARGES	1
BANDWIDTHCOMPRESSED	1
(L1 AND (BANDWIDTH$ SAME (QUALITY ADJ1 OF ADJ1 SERVICE$) SAME REQUEST$ WITH AVAILAB$)).USPT.	0

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Database:

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US Patents Full-Text Database
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EPO Abstracts Database
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IBM Technical Disclosure Bulletins

Search: L3

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Friday, May 07, 2004 Printable Copy Create Case

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DB=USPT; PLUR=YES; OP=ADJ

L3	L1 and (bandwidth$ same (quality adj1 of adj1 service$) same request$ with availab$)	0	L3
L2	L1 and (bandwidth$ same QOS same request$ with availab$)	2	L2
L1	(6484212 or 5497504 or 5313454 or 6223222 or 6055571 or 5724513).pn.	6	L1

END OF SEARCH HISTORY

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DB=USPT; PLUR=YES; OP=ADJ			
L3	L1 and (network$ with determin$ with bandwidth$ with ((QOS) or (quality adj1 of adj1 service)))	10	L3
L2	L1 and (network$ with bandwidth$ with ((QOS) or (quality adj1 of adj1 service)))	93	L2
L1	709/$.ccls.	15169	L1

END OF SEARCH HISTORY

L3 / 4, 7, 10.

6,223,222

6,055,571

5,724,513

First Hit Fwd Refs

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L3: Entry 4 of 10 File: USPT Apr 24, 2001

DOCUMENT-IDENTIFIER: US 6223222 B1
TITLE: Method and system for providing quality-of-service in a data-over-cable system using configuration protocol messaging

Detailed Description Text (152):
A system for a preferred embodiment of the present invention includes a quality-of-service server (e.g., QoS server 332), for determining whether a first network device has enough available bandwidth to establish a connection to a second network device with a specific quality-of-service requested by the second network device. The quality-of-service server provides support for class-of-service, quality-of-service and other parameters. The system also includes multiple quality-of-service identifiers, for identifying a transmission bandwidth required for a specific quality-of-service requested by a second network device, wherein a value for a quality-of-service identifier is determined by the quality-of-service bandwidth requested by class-of-service, quality-of-service and other parameters. In a preferred embodiment of the present invention, the quality-of-service server is QoS server 332, the first network device is CMTS 12 and the second network device is CM 16. However, the present invention is not limited to these network devices and other network devices could also be used.

Detailed Description Text (156):
FIG. 23 is a block diagram illustrating a data-over-cable system 400 with a QoS server 402 that is also a DHCP 66 server. QoS server 402 determines if CMTS 12 has available bandwidth for network devices such as CM 16 for quality-of-service requests in data-over-cable system 400 using DHCP 66 messaging. Bandwidth is allocated for class-of-service, quality-of-service and other parameters and is hereinafter collectively referred to as "quality-of-service" bandwidth for the sake of simplicity. FIG. 23 is similar to FIG. 18 except DHCP server 160 includes quality-of-service capabilities and is illustrated as QoS server 402. In a preferred embodiment of the present invention, DHCP server 160 is integral to QoS server 402. In such an embodiment, QoS server 402 is used to provide DHCP 66 finctionality as described above as well as quality-of-service functionality. In another embodiment of the present invention, quality-of-service server 402 is a separate server with DHCP 66 and quality-of-service capabilities (e.g., server 332 FIG. 18). In such an embodiment, DHCP server 160 is used for DHCP 66 messaging and QoS server 402 provides quality-of-service capabilities with DHCP 66 messaging.

Detailed Description Text (178):
A system for a preferred embodiment of the present invention includes a quality-of-service server (e.g., QoS 402), for determining whether a first network device has enough available bandwidth to establish a connection to a second network device with a specific quality-of-service requested by the second network device. The quality-of-service server provides support for class-of-service, quality-of-service and other parameters with DHCP 66 messaging.

Current US Original Classification (1):
709/227

First Hit Fwd Refs

Generate Collection

L3: Entry 10 of 10 File: USPT Mar 3, 1998

DOCUMENT-IDENTIFIER: US 5724513 A
TITLE: Traffic shaping system for asynchronous transfer mode networks

Brief Summary Text (7):
The network initially uses the QoS parameters in the connection request for admission control. When a connection request is made, the network determines whether sufficient resources (transmission bandwidth, buffers, or other) exist to allow the connection to be established with the requested parameters, while not impacting the QoS of already established connections. If there are insufficient resources to support the requested QoS, the connection request is rejected, and the station may repeat the request with lower QoS parameters.

Detailed Description Text (7):
The network responds to the connection request issued by the user on End Station 1 10 by either creating the requested VC, or denying the request. In determining whether a requested VC can be established between End Station 1 10 and End Station 2 25, the network determines whether there are sufficient resources (for example transmission bandwidth and buffers) across the network from source to destination, for example in Intermediate Station 1 15 and Intermediate Station 2 20, to allow the requested VC to be set up with the requested QoS parameters, while not impacting the QoS of already established VCs. If there are not sufficient resources to do so, the connection request is rejected, and the user on End Station 1 10 may repeat the request with lower QoS parameters.

Current US Original Classification (1):
709/234

Current US Cross Reference Classification (1):
709/238

First Hit Fwd Refs

Generate Collection

L3: Entry 7 of 10 File: USPT Apr 25, 2000

DOCUMENT-IDENTIFIER: US 6055571 A
TITLE: Computer network with microeconomic flow control

Detailed Description Text (40):
In FIG. 15, the plotted curve is called the softness profile and is derived by setting B at a value shortly to be described; by setting A at about 1.1 times B; and by setting C at about 0.7 times B. In FIG. 15, the horizontal axis is the bandwidth ratio. The bandwidth ratio is the ratio of "purchased" bandwidth to "desired" bandwidth. If the bandwidth ratio is 1, it means the user can afford the bandwidth he desires and thus the satisfaction is total (indicated as 5 in the vertical axis, which represents a satisfaction index). The value B is the percentage of the desired bandwidth corresponding to a level of performance which, although not to the level desired, provides good quality of service to the user for the given application. In other words, to maintain good (i.e., acceptably degraded) performance, the application needs to purchase at least B % of the desired bandwidth. Table 1 shows an example of how B may vary according to the different categories of applications. Thus, once the NB gets the price, it uses the application's particular QoS profile to determine how much bandwidth it should ask the network for. The exact form of the softness profile depends on the application.

Current US Original Classification (1):
709/224

C8

Hit List

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Search Results - Record(s) 1 through 1 of 1 returned.

☐ 1. Document ID: US 6223222 B1

L8: Entry 1 of 1 File: USPT Apr 24, 2001

DOCUMENT-IDENTIFIER: US 6223222 B1
TITLE: Method and system for providing quality-of-service in a data-over-cable system using configuration protocol messaging

Brief Summary Text (13):
As is known in the art, class-of-service provides a reliable (e.g., error free, in sequence, with no loss of duplication) transport facility independent of the quality-of-service. Class-of-service parameters include maximum downstream data rates, maximum upstream data rates, upstream channel priority, guaranteed minimum data rates, guaranteed maximum data rate and other parameters. Quality-of-service collectively specifies the performance of a network service that a device expects on a network. Quality-of-service parameters include transit delay expected to deliver data to a specific destination, the level of protection from unauthorized monitoring or modification of data, cost for delivery of data, expected residual error probability, the relative priority associated with the data and other parameters.

Detailed Description Text (22):
CM 16 forwards IP 54 datagrams destined to an IP 54 unicast address across cable network 14 or PSTN 22. Some routers have security features intended to filter out invalid users who alter or masquerade packets as if sent from a valid user. Since routing policy is under the control of network operators, such filtering is a vendor specific implementation. For example, dedicated interfaces (i.e., Frame Relay) may exist between TRAC 24 and CMTS 12 which preclude filtering, or various forms of virtual tunneling and reverse virtual tunneling could be used to virtually source upstream packets from CM 16. For more information on virtual tunneling see Level 2 Tunneling Protocol ("L2TP") or Point-to-Point Tunneling Protocol ("PPTP") in IETF draft documents incorporated herein by reference by Kory Hamzeh, et. al (IETF draft documents are precursors to IETF RFCs and are works in progress).

Detailed Description Text (23):
CM 16 also forwards IP 54 datagrams destined to an IP 54 multicast address across cable network 14 or PSTN 22. CM 16 is configurable to keep IP 54 multicast routing tables and to use group membership protocols. CM 16 is also capable of IP 54 tunneling upstream through the telephony path. A CM 16 that wants to send a multicast packet across a virtual tunnel will prepend another IP 54 header, set the destination address in the new header to be the unicast address of CMTS 12 at the other end of the tunnel, and set the IP 54 protocol field to be four, which means the next protocol is IP 54.

Detailed Description Text (41):
The virtual connection includes receiving data on the first network host interface

on the first network from the third network and sending the data over the downstream connection to the first network device. The first network device sends data responses back to the third network over the upstream connection to the second network, which forwards the data to the appropriate destination on the third network.

Detailed Description Text (127):
QoS parameters include transit delay expected to deliver data to a specific destination, the level of protection from unauthorized monitoring or modification of data, cost for delivery of data, expected residual error probability, the relative priority associated with the data and other parameters.

Detailed Description Text (140):
FIG. 20 is flow diagram illustrating a method 352 for providing quality-of-service to a cable modem. At step 354, QoS server 332 receives a request from CMTS 12 to establish a connection between CMTS 12 and CM 16 with a specific quality-of-service requested by CM 16 (e.g., for CoS, QoS and other parameters in Tables 10-20). At step 356, QoS server 332 determines whether CMTS 12 has enough available bandwidth to establish the connection to CM 16 with the specific quality-of-service requested by CM 16. If CMTS 12 has enough bandwidth (e.g., for CoS, QoS and other parameters in tables 10-20) to establish the connection to CM 16 with the specific quality-of-service requested by CM 16, a bandwidth required for the specific quality-of-service requested by CM 16 is subtracted from an available bandwidth for CMTS 12 at step 358. At step 360, a quality-of-service identifier is assigned to the specific quality-of-service bandwidth requested by CM 16. The assigned quality-of-service identifier is saved on QoS server at step 362. At step 364, The assigned quality-of-service identifier source identifier is sent to CMTS 12 indicating that CMTS 12 has enough bandwidth to allow the connection with the specific quality-of-service requested by CM 16. If CMTS 12 does not have enough available bandwidth to establish the connection to CM 16 with the specific quality-of-service requested by CM 16 at step 340, a rejection is sent to CMTS 12 at step 365.

Detailed Description Paragraph Table (3):
TABLE 3 1. An IP 54 datagram from data network 28 destined for CM 16 arrives on CMTS-NSI 32 and enters CMTS 12. 2. CMTS 12 encodes the IP 54 datagram in a cable data frame, passes it to MAC 44 and transmits it "downstream" to RF interface 40 on CM 16 via cable network 14. 3. CM 16 recognizes the encoded IP 54 datagram in MAC layer 44 received via RF interface 40. 4. CM 16 responds to the cable data frame and encapsulates a response IP 54 datagram in a PPP 50 frame and transmits it "upstream" with modem interface 48 via PSTN 22 to TRAC 24. 5. TRAC 24 decodes the IP 54 datagram and forwards it via TRAC-NSI 30 to a destination on data network 28.

Detailed Description Paragraph Table (16):
TABLE 16 Type/Subtype Length Description of Value Default Value Bx N Service Identifier Header B0 1 Service Identifier Type 0 B1 1 Number of Service 1 Identifier's (SIDs) to be given with this definition B2 4 Flow Identifier for 0 SIDs B3 4 CoS for SIDs 0 B4 4 Source IP 54 address CM's IP 54 address B5 4 Source IP 54 address 255.255.255.255 mask B6 4 Destination IP 54 255.255.255.255 address B7 4 Destination IP 54 255.255.255.255 address mask B8 1 IP Protocol Type 256 B9 4 Source Port (Start) 0 B10 4 Source Port (End) 65,535 B11 4 Destination Port 0 (Start) B12 4 Destination Port (End) 65,535 B13 1 Precedence and TOS 0 B14 1 Precedence and TOS 255 Mask B15 N Multicast group Null string"" definition B16 4 Protocol Type Oxffffffff B17-B127 N Reserved B128-B255 N Vendor Specific

L8	L6 and (destinat$ or source$)	1	L8
L7	L6 and (destinat$ or originat$)	1	L7
L6	6223222.pn.	1	L6
L5	L2 and (destinat$ and originat$)	0	L5
L4	L2 and (destinat$ or originat$)	2	L4
L3	L1 and (bandwidth$ same (quality adj1 of adj1 service$) same request$ with availab$)	0	L3
L2	L1 and (bandwidth$ same QOS same request$ with availab$)	2	L2
L1	(6484212 or 5497504 or 5313454 or 6223222 or 6055571 or 5724513).pn.	6	L1

END OF SEARCH HISTORY

L2

Hit List

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Search Results - Record(s) 1 through 2 of 2 returned.

☐ 1. Document ID: US 6223222 B1

L2: Entry 1 of 2 File: USPT Apr 24, 2001

DOCUMENT-IDENTIFIER: US 6223222 B1
TITLE: Method and system for providing quality-of-service in a data-over-cable system using configuration protocol messaging

Detailed Description Text (124):
FIG. 18 is a block diagram illustrating data-over-cable system 330 used for a preferred embodiment of the present invention. Data-over-cable system 330 is similar to the data over cable system illustrated in FIG. 8. However, FIG. 18 illustrates a QoS server 332 used to determine whether CMTS 12 has available bandwidth to provide a specific quality-of-service request to a CM 16. A quality-of-service bandwidth request includes bandwidth allocated for CoS, QoS and other related parameters and is hereinafter called "quality-of-service "bandwidth request". QoS server 332 handles CoS, QoS and other related parameters and is hereinafter called a "QoS server" for the sake of simplicity. QoS server 332 maintains multiple q uality-of-service identifiers allocated with a database 334 for CoS and other QoS designations. The multiple quality-of-service identifiers are an indication of CoS, QoS and other related parameters requested by CM 16 and are collectively called "quality-of-service identifiers" for the sake of simplicity. FIG. 18 illustrates QoS server 332 separate from CMTS 12 in TRTS 26. However QoS server 332 may also be integral to CMTS 12 (e.g., as a dedicated QoS process running on CMTS 12 or integrated into DHCP 66 server 160).

Detailed Description Text (138):
FIG. 19 is a flow diagram illustrating a method 336 for providing quality of service for a network device in a data over-cable-system. Method 336 includes receiving a request on a first network device from a second network device to establish a connection between the second network device and a third network device with a specific quality-of-service at step 338. The quality-of-service request includes bandwidth for CoS, QoS and other parameters. The first network device determines whether the second network device has enough available bandwidth to establish the connection to the third network device with the specific quality-of-service requested at step 340. The bandwidth determination includes a bandwidth determination required for CoS, QoS and other parameters. If the first network device has enough bandwidth to establish the connection to the third network device with the specific quality-of-service at step 340, a bandwidth required for the specific quality-of-service is subtracted from an available bandwidth for the second network device at step 342. At step 344, a quality-of-service identifier is assigned to the specific quality-of-service bandwidth requested. The quality-of-service identifier is assigned based on bandwidth required CoS, QoS and other parameters. The assigned quality-of-service identifier is saved on the first network device at step 346. The assigned quality-of-service identifier is sent to the second network device indicating the second network device has enough bandwidth

to allow the connection with the specific quality-of-service requested at step 348. If the first network device does not have enough available bandwidth to establish the connection to the third network device with the specific quality-of-service requested by the third network device at step 340, a rejection is sent to the first network device at step 350.

Detailed Description Text (140):
FIG. 20 is flow diagram illustrating a method 352 for providing quality-of-service to a cable modem. At step 354, QoS server 332 receives a request from CMTS 12 to establish a connection between CMTS 12 and CM 16 with a specific quality-of-service requested by CM 16 (e.g., for CoS, QoS and other parameters in Tables 10-20). At step 356, QoS server 332 determines whether CMTS 12 has enough available bandwidth to establish the connection to CM 16 with the specific quality-of-service requested by CM 16. If CMTS 12 has enough bandwidth (e.g., for CoS, QoS and other parameters in tables 10-20) to establish the connection to CM 16 with the specific quality-of-service requested by CM 16, a bandwidth required for the specific quality-of-service requested by CM 16 is subtracted from an available bandwidth for CMTS 12 at step 358. At step 360, a quality-of-service identifier is assigned to the specific quality-of-service bandwidth requested by CM 16. The assigned quality-of-service identifier is saved on QoS server at step 362. At step 364, The assigned quality-of-service identifier source identifier is sent to CMTS 12 indicating that CMTS 12 has enough bandwidth to allow the connection with the specific quality-of-service requested by CM 16. If CMTS 12 does not have enough available bandwidth to establish the connection to CM 16 with the specific quality-of-service requested by CM 16 at step 340, a rejection is sent to CMTS 12 at step 365.

Detailed Description Text (148):
In one embodiment of the present invention, QoS server determines bandwidth available on CMTS 12 with quality-of-service identifiers assigned to CMTS 12 and subtracting QoS bandwidth from an available bandwidth. For example, if CMTS 12 has a total available bandwidth of 1000 Mbps and has allocated ten CoS-1 quality-of-service requests at 12 Mbps each, and 5 CoS-2 quality-of-service requests at 6 Mbps each, then CMTS 12 has 850 Mbps of available bandwidth remaining (1000 Mbps-(10*12+5*6)Mbps=850 Mbps).

Detailed Description Text (150):
A preferred embodiment of the present invention is illustrated with interactions between CM 16, CMTS 12 and QoS 332. However, the present invention can also be practiced by making QoS requests directly to QoS server 332 directly from CM 16. In such an embodiment, CM 16 sends a quality-of-service identifier returned from QoS server 332 in a registration message to CMTS 12. CMTS 12 allocates a connection with a specific quality of service requested by CM 16 when a quality-of-service identifier is detected in the registration message, indicating that CMTS12 has available bandwidth for the specific quality-of-service request.

Detailed Description Text (151):
A preferred embodiment of the present invention is described for one CMTS 12 as is illustrated in FIG. 18. However, QoS server 332 can also be used to handle and balance CoS, QoS and other requests among multiple CMTS 12 (not illustrated in FIG. 18). For example, if CM 16 makes a connection request with a requested quality-of-service for a first CMTS 12, and first CMTS 12 does not have the available bandwidth, QoS server 332 directs a second CMTS with available bandwidth to respond to the connection request from CM 16.

Detailed Description Text (152):
A system for a preferred embodiment of the present invention includes a quality-of-service server (e.g., QoS server 332), for determining whether a first network device has enough available bandwidth to establish a connection to a second network device with a specific quality-of-service requested by the second network device. The quality-of-service server provides support for class-of-service, quality-of-

service and other parameters. The system also includes multiple quality-of-service identifiers, for identifying a transmission bandwidth required for a specific quality-of-service requested by a second network device, wherein a value for a quality-of-service identifier is determined by the quality-of-service bandwidth requested by class-of-service, quality-of-service and other parameters. In a preferred embodiment of the present invention, the quality-of-service server is QoS server 332, the first network device is CMTS 12 and the second network device is CM 16. However, the present invention is not limited to these network devices and other network devices could also be used.

Detailed Description Text (156):
FIG. 23 is a block diagram illustrating a data-over-cable system 400 with a QoS server 402 that is also a DHCP 66 server. QoS server 402 determines if CMTS 12 has available bandwidth for network devices such as CM 16 for quality-of-service requests in data-over-cable system 400 using DHCP 66 messaging. Bandwidth is allocated for class-of-service, quality-of-service and other parameters and is hereinafter collectively referred to as "quality-of-service" bandwidth for the sake of simplicity. FIG. 23 is similar to FIG. 18 except DHCP server 160 includes quality-of-service capabilities and is illustrated as QoS server 402. In a preferred embodiment of the present invention, DHCP server 160 is integral to QoS server 402. In such an embodiment, QoS server 402 is used to provide DHCP 66 finctionality as described above as well as quality-of-service functionality. In another embodiment of the present invention, quality-of-service server 402 is a separate server with DHCP 66 and quality-of-service capabilities (e.g., server 332 FIG. 18). In such an embodiment, DHCP server 160 is used for DHCP 66 messaging and QoS server 402 provides quality-of-service capabilities with DHCP 66 messaging.

Detailed Description Text (161):
FIG. 25 is a flow diagram illustrating a method 414 for determining quality-of-service. At step 416, a DHCP 66 discover message is sent from CMTS 12 to QoS server 402. The DHCP 66 discover message includes a request to determine if CMTS 12 has enough available bandwidth to create a connection to CM 16 with a specific quality-of-service requested by CM 16. At step 418, a DHCP 66 offer message is received on CMTS 12 from QoS server 402 in response to the DHCP 66 discover message. The DHCP 66 offer message is an offer to reserve bandwidth for CMTS 12 for the specific quality-of-service requested by CM 16. The offer message is sent by QoS server 402 using method 352 (FIG. 20) if CMTS 12 has enough available bandwidth to provide a connection to CM 16 with the specific quality-of-service requested. The DHCP 66 offer message includes a quality-of-service identifier for the specific quality-of-service requested in DHCP 66 giaddr-field 130 (FIG. 6). If CMTS 12 does not have enough available bandwidth to provide a connection for the specific quality-of-service requested by CM 16, QoS server 402 sends a DHCP 66 negative acknowledgment message (i.e., DHCP_NACK). The DHCP 66 negative acknowledgment message indicates no bandwidth is available on CMTS 12 to provide the specific quality-of-service request.

Detailed Description Text (167):
FIG. 27 is a block diagram illustrating a message flow 428 for quality-of-service requests from CM 16. CM 16 executes the steps of method 414 (FIG. 25) using the same DHCP 66 messages as was described for CMTS 12. CM 16 sends a DHCP 66 discover message 430 to QoS server 402 to determine if CMTS 12 has enough available bandwidth to provide the desired quality-of-service connection requested by CM 16. CM 16 receives a DHCP 66 offer message 432 with a hashed quality-of-service identifier in a DHCP 66 giaddr-field 130 from QoS server 402 via a downstream channel from CMTS 12. CM 16 sends a DHCP request message 434 to QoS server 402 with the hashed quality-of-service identifier obtained the DHCP 66 offer message in a DHCP 66 giaddr-field 130. DHCP 66 request message 434 with the hashed quality-of-service identifier indicates that CM 16 desires to allocate bandwidth on CMTS 12 for the quality-of-service connection requested by CM 16. CM 16 receives a DHCP 66 acknowledgment message 436 from QoS server 402 including the hashed quality-of-

service identifier in DHCP 66 giaddr-field 130, and indicating that bandwidth for the quality-of-service connection requested by CM 16 has been allocated from available bandwidth on CMTS 12.

Detailed Description Text (178):
A system for a preferred embodiment of the present invention includes a quality-of-service server (e.g., QoS 402), for determining whether a first network device has enough available bandwidth to establish a connection to a second network device with a specific quality-of-service requested by the second network device. The quality-of-service server provides support for class-of-service, quality-of-service and other parameters with DHCP 66 messaging.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 2. Document ID: US 6055571 A

L2: Entry 2 of 2 File: USPT Apr 25, 2000

DOCUMENT-IDENTIFIER: US 6055571 A
TITLE: Computer network with microeconomic flow control

Detailed Description Text (76):
This technique requires signaling to allocate resources. Once a user wishes to (re) negotiate for more resources they must send a request to the switches in the route. Each switch reads the request and determines the amount of bandwidth it can allocate. Allocation is performed on a first come first served basis. If the switch is unable to allocate the requested amount, it changes the request to its available amount. The new request is then forwarded to the next switch, where the process is repeated. The last switch then forwards the request back to the user. The result is an allocation which is the minimum amount available in the route. Once the message has reached the NB, it must decide if the allocated amount is sufficient using the QoS profile given in FIG. 5. If so, it will start sending at the allocated value. Note this allocation process requires at least a round trip propagation delay before a higher rate can be sent. If the user wishes to use less resources, it can do so immediately but must also notify the switches in the route. This is a reactive strategy, since the user does not scale back until the network cannot support their demands.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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Term	Documents
QOS	2386
QO	1081
QOES	3
QOE	19

BANDWIDTH$	0
BANDWIDTH	99418
BANDWIDTHALLOCATED	1
BANDWIDTHBJ	1
BANDWIDTHCHARGES	1
BANDWIDTHCOMPRESSED	1
BANDWIDTHCONFIRM	1
(L1 AND (BANDWIDTH$ SAME QOS SAME REQUEST$ WITH AVAILAB$)).USPT.	2

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Display Format: KWIC Change Format

Previous Page Next Page Go to Doc#

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L3	L2 and (request$ and availab$).ab.	130	L3
L2	(bandwidth$).ab.	9066	L2
L1	(bandwidth$ and alocat$).ab.	0	L1

END OF SEARCH HISTORY

L5/2, 6, 7, 8,

6,484,212

5,946,322

5,818,845

5,448,559

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L3	L2 and (request$ and availab$).ab.	130	L3
L2	(bandwidth$).ab.	9066	L2
L1	(bandwidth$ and alocat$).ab.	0	L1

END OF SEARCH HISTORY

DOCUMENT-IDENTIFIER: US 5497504 A
TITLE: System and method for connection control in mobile communications

Brief Summary Text (4):
In recent years, the popularity of mobile communications has increased immensely and is expected to grow in the near future to the point where existing systems will be unable to support the demand for such communications. A major problem facing the future of mobile communications systems is the scarcity of available bandwidth in a wireless network for the mobile user's transmission to a fixed network.

Brief Summary Text (7):
Due to the limited bandwidth available for the wireless transmissions of mobile users' calls, each cell can handle only a limited number of calls. Overload conditions occur when the communication needs of wireless terminals populating a small area exceed the total capacity of all access points within their reach. This situation is referred to as a "radio congestion state." Such a state may be encountered during a hand-off, resulting in connection dropping, long delays, and/or packet losses.

Detailed Description Text (16):
Class II connections encompass data connections which support applications requiring reliable transport. Calls utilizing a standard transmission control protocol (TCP) typify such connections. In contrast to class I, class II connections may be "put on hold" when a radio congestion state is encountered. Relying on the transport protocol of the packets for example, the end-to-end connection control entities detect any congestion, and reduce or even stop the flow of the packets when such congestion occurs. As a result, class II connections are more susceptible to delays (or even packet losses) in a congestion state than under normal conditions. Once the congestion state is over, the normal flow of packets in the network resumes. An important QOS metric for a class II connection is thus an overload probability, which measures the likelihood of occurrences of the radio congestion state. The average duration of the congestion state is another important QOS metric for this class. Also important is the QOS metric of a minimum bandwidth service probability. This probability measures the percentage of a connection duration during which the class II connection is afforded bandwidth more than a specified amount.

Detailed Description Text (24):
Specifically, processor 501 queries the mobile user as to the type of connections required, as indicated at step 503. By way of example, but not limitation, the mobile user in this instance requests, say, a type A connection. Processor 201 records in memory 203 the current numbers of connections of types A, B, and C which have been admitted and not yet terminated in cell-cluster 45. At step 505, processor 201 retrieves the current numbers of the different connections from memory 203. Processor 201 then proceeds to step 507 where it looks up the connection table of FIG. 3 and searches for a row which contains the numbers of type B and C connections identical to and/or just larger than the respective current numbers. Processor 201 then determines at step 509 whether the number of type A connections appearing in the row just identified is greater than the current number of type A connections. If it is not greater, processor 201 rejects the call

request initiated by the mobile user through the associated base station, as indicated at step 511. Otherwise, processor 201 proceeds to step 513 where it further queries the mobile user as to other requirements such as bandwidth, call holding time and hand-off rate requirements.

Detailed Description Text (25):
After collecting the necessary information which forms a call profile of the requested connection, processor 201 reviews the local policies of each cell in cell-cluster 45, including the sharing and scheduling policies of the different call classes in the cell, as indicated at step 515. The sharing and scheduling policies may particularize the proportions of the cell bandwidth which need to be maintained among the different classes of connections. If upon review the local policies are not satisfied, processor 201 returns to step 511 where the call request is again rejected. Otherwise, processor 201 grants admission of the requested call to the cell where the mobile user is in, and assigns an unused VCI to the newly-admitted call for identification, as indicated at step 517. Processor 201 then sends at step 519 the profile of the new call, along with its VCI, to each base station so that the same profile need not be elicited during a future hand-off. Finally, at step 521, processor 201 updates memory 203 to reflect the latest numbers of the different types of connections in cell-cluster 45.

Other Reference Publication (11):
J. Turner, "Managing Bandwidth in ATM Networks with Bursty Traffic," IEEE Network, pp. 50-57, Sep. 1992.

CLAIMS:

5. The system of claim 2 wherein a metric for one of said qualities of service is a probability of receiving at least a specified amount of bandwidth during a connection lifetime.

15. The system of claim 12 wherein a metric for one of said qualities of service is a probability of receiving at least a specified amount of bandwidth during a connection lifetime.

25. The method of claim 22 wherein a metric for one of said qualities of service is a probability of receiving at least a specified amount of bandwidth during a connection lifetime.

35. The method of claim 32 wherein a metric for one of said qualities of service is a probability of receiving at least a specified amount of bandwidth during a connection lifetime.

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L3: Entry 2 of 2 File: USPT May 17, 1994

DOCUMENT-IDENTIFIER: US 5313454 A
TITLE: Congestion control for cell networks

Abstract Text (1):
A feedback control system for congestion prevention in a cell (packet) switching communication network is described. Congestion control is accomplished by controlling the transmission rate of bursty traffic in the presence of high priority, voice, low speed statistical, high speed deterministic and multicast data. Because bursty traffic is relatively insensitive to delay, adequate buffer capacity can be provided at the network nodes in order to minimize bursty data cell loss. By monitoring the buffer queue lengths at the nodes, a control signal can be generated at each intermediate node indicating the state of congestion. Excess queue length indicates incipient congestion while short queue lengths indicate excess capacity. Queue status is forwarded to the destination node where it is interpreted and sent back to the source node as a feedback rate control signal using a 2-bit code. The source node regulates the rate of bursty data transmission over the cell network in accordance with the feedback control signal thus minimizing congestion and concomitant data loss while efficiently utilizing available network bandwidth.

Brief Summary Text (13):
Each of these six traffic types are buffered at each network node in accordance with their particular sensitivities to network delay and cell loss. Cell loss may occur due to intermittent short term overload of network bandwidth and lack of adequate buffer capacity. For example, voice traffic is relatively delay sensitive and insensitive to occasional cell loss. In contrast, data traffic, such as file transfers, is relatively insensitive to delay but is data loss sensitive. High priority data is both delay and loss sensitive. To accommodate these differences, each class of traffic is typically placed in a preassigned queue, each with a different service priority. During periods of network traffic congestion, when network traffic demand exceeds the network's bandwidth capacity, servicing algorithms are typically employed to discriminate between traffic classes in order to allocate bandwidth. Delay is managed by properly sizing the queue depths and prioritizing transmission within a class based upon a measure of the time that a cell has been in the network as, for example, by use of time stamps and hop counts.

Brief Summary Text (14):
Even with these sophisticated queueing and service algorithms, congestion (due to excess arriving traffic) can occur. This congestion is typically divided into three categories: short-term, medium-term, and long-term. Short-term congestion, typically handled by discarding traffic at the queue, may be done haphazardly or preferably selectively by having cells marked with their "discard eligibility". Long-term congestion is controlled by admission policies that allocate resources (bandwidth and buffers) at the time a connection is established. If no resources are available, the connection is not allowed.

Brief Summary Text (16):
An example of a general rate regulation scheme for a bursty data source on a per virtual connection basis is described in a paper by K. Bala, et al., entitled,

Congestion Control for High Speed Packet Switched Networks, published in the proceedings of the IEEE INFOCOM Jun. 5-7, 1990, pages 520-526. At the initial establishment of a virtual connection, a minimum amount of guaranteed bandwidth is allocated. The simplest system described uses the concept of a "leaky bucket" input rate controller that uses "tokens" and "spacers" to control the average data rate introduced into the packet switched network. Tokens arrive at the controller at a fixed rate. Each token corresponds to fixed number of bytes. The controller buffers the packet until enough tokens are collected for transmitting the entire packet. The token bucket has a fixed maximum capacity corresponding to the maximum packet burst duration. Tokens arriving to a full bucket are dropped. Thus, the system can handle different length packets which are transmitted without fragmentation. Peak rate control is accomplished by means of a spacer that introduces a suitable delay proportional to the length of the prior transmitted packet.

Brief Summary Text (17):
A given session on a virtual connection may last for long periods of time (up to hours). Bursty data sources are characterized by intermittent high data rate burst with significant spans of inactivity between bursts. Under these circumstances, the above described simplest system would result in underutilization of the bandwidth capacity of the system because of the prescribed safe bandwidth limit assigned to the virtual connection session.

Brief Summary Text (18):
Average bandwidth utilization efficiency is typically improved by introducing "colored" tokens, for example, green and red. Green tokens correspond to packets received for transmission that fall within the minimum guaranteed bandwidth protocol while the red tokens correspond to packet data received for transmission in excess of the guaranteed minimum rate. Intermediate nodes provide per trunk FIFO buffer service and use the colors associated with each packet for congestion control. In general, green packets are protected and passed along while red packets are discarded upon arrival whenever the chosen metric (usually queue lengths) for congestion threshold is exceeded. Even though discarding of packets implies retransmission of the lost packet data, the system is represented as improving the average utilization of bandwidth capacity.

Brief Summary Text (23):
In summary, Ramakrishnan and Jain describe a system using window control at the ISO Transport layer using window duration control rather than rate control. Rate control is indirectly controlled by the limiting actions of acknowledgements and window length. Because transmission rate is a direct measure of bandwidth, better short term control of this system resource can be obtained by direct rate control.

Brief Summary Text (27):
One object of the present invention is to optimize the use of available system bandwidth.

Brief Summary Text (29):
Another object of the present invention is to provide a dynamic bandwidth (or data rate) allocation scheme that allows individual users to use unused network capacity for increasing throughput when necessary to accommodate the peak loads of individual users.

Detailed Description Text (3):
Each node 22 incorporates a T1 transmitter/receiver that includes the fair queuing and servicing circuitry. The T1 transmitter/receivers support six classes of cell traffic: high priority (HP), voice, low speed statistical (LSS), high speed deterministic (HSD), bursty, and multicast. As will be discussed in detail below, each T1 transmitter/receiver supports the traffic classes via six queues and a service routine. The service routine guarantees a minimum amount of bandwidth to each class of traffic under normal operation and allocates spare bandwidth

according to a predefined priority scheme.

Detailed Description Text (29):
FIG. 5 is an example of a four node network 20 for use in explaining the onset of congestion interval to network 20. Assume that a bursty data working connection between user A at node 22-A and user C1 at 22-C via node 22-B involving FRP 59A1, TXR 56A1, TXR 56B1, TXR 56B2, TXR 56C1, and FRP 59C1. Further, assume that user D subsequently establishes a working bursty data connection through node B to user C2 at node 22-C involving FRP 59D1, TXR 56D1, TXR 56B3, TXR 56B2, TXR 56C1, and FRP 59C2. If either user A or D should increase their transmission rate because of an excess available input load, node 22-B could become congested at the common TXR 56B2 (shown shaded) if the combined bursty data rate exceeds the available capacity on trunk 42 connecting nodes 22-B and 22-C. Similarly, congestion could occur in the reverse direction at TXR 56B3 of node 22-B interfacing with cell trunk 42 connecting node 22-B and 22-D if the combined bursty traffic between user C2 and node 22-D plus that between, say, user B and node D exceeded the available bandwidth between nodes 22-B and 22-D.

Detailed Description Text (30):
FIG. 6 shows the effects of congestion on effective network bandwidth and delay as a function of the offered load bandwidth. At low average load rates (Region I), throughput increases linearly with load, while delay shows a moderate rate of increase with load. When throughput approaches the network's information rate capacity, mild congestion results (Region II) as average queue lengths increase. Throughput saturates, increasing only slightly with increased offered load, while delay exhibits sharp increases. Finally, if the offered load increases some more, threshold is exceeded when Region III is reached, causing a breakdown in throughput (severe congestion) and hence unlimited delay because of data losses requiring constant retransmission.

Detailed Description Text (31):
In order to efficiently use the bandwidth resource of a cell switching network, it is desirable that peak offered loads be accommodated by adequate buffering, particularly for bursty data which is more tolerant of network delay. Bursty data tends to be high-bandwidth short-duration messages that, if uncontrolled, may either cause congestion or require that the network operate with a high percentage of average unused bandwidth. Ideally, the average offered load would operate at point A of FIG. 6, where peak loads would not be likely to cause severe congestion.

Detailed Description Text (82):
Table 1 is an example that details the mapping of service order, j, and spare bandwidth priorities, k, for each class of traffic, i, in the preferred embodiment. Note that the service priority is according to assigned minimum bandwidth.

Detailed Description Text (83):
The servicing routine uses a credit accrual scheme to ensure that each class of traffic receives a selectable minimum bandwidth. In selecting minimum bandwidths for each class of traffic, let N denote the total available bandwidth on a cell T1 trunk and let T denote the queue server tick interval. The unit of N is not relevant; it can be specified as a number of cells per second, or any other throughput unit. For a non-fractional T1 trunk N=8000 cells per second. Similarly T can be given in any convenient unit of time. For one embodiment of the node, the tick interval T equals 125 microseconds. Thus, the product N*T represents the capacity of the cell trunk per tick interval, or the quantum of bandwidth.

Detailed Description Text (84):
Each class of traffic is assigned a minimum amount of the quantum of bandwidth, with the exception of high priority traffic. This is because all high priority traffic will be serviced regardless of the required bandwidth. The sum of the

minimum class bandwidths must be less than N to allow some bandwidth for high priority traffic. In other words, if i represents the class number, and N.sub.i represents the minimum bandwidth assigned to the i.sup.th traffic class, then N.sub.1 +N.sub.2 +N.sub.3 +N.sub.4 +N.sub.5 <N.

Detailed Description Text (85):
Each minimum bandwidth N.sub.i can be transformed into a timer value, D.sub.i, representative of the number of tick intervals T that must elapse for traffic class i to acquire its quantum of bandwidth. The timer value D.sub.i =(1/N.sub.i)/T. Note that D.sub.i may not be an integer value because it represents a ratio of bandwidths, i.e., D.sub.i =N/N.sub.i because N*T=1.

Detailed Description Text (86):
Given selected timer values D.sub.i for i=1, 2, 3, 4, 5, a credit accrual routine runs simultaneously with the service routine. Each class of traffic i is assigned a timer T.sub.i, which is initialized to the associated timer value, D.sub.i. The timer T.sub.i is decremented every T units of time. When the value of timer T.sub.i is less than or equal to zero a transmission credit C.sub.i accrues for traffic class i. Because of the inverse relationship between N.sub.i and D.sub.i, the greater the allocated minimum bandwidth for a class of traffic, the faster the rate at which it acquires transmission credit. The presence of a transmission credit permits a cell from traffic class i to be serviced. After servicing of class i, timer T.sub.i is updated by adding D.sub.i to the previous value of T.sub.i. Using this method of accrual, each class of traffic i accrues N.sub.i credit in a tick interval of T.

Detailed Description Text (88):
FIG. 14(a) is a flow diagram of the service routine for a single tick interval implemented by queue manager 76. Using a credit based strategy for servicing cell traffic, queue manager 76 guarantees each class of traffic a minimum bandwidth.

Detailed Description Text (92):
If Q.sub.i or C.sub.i =0, no credit is available for class i or no cell is queued for class i, then spare bandwidth results. Consequently, index B, which indicates the number of spare bandwidth credits available is incremented in step 416.

Detailed Description Text (93):
Step 418 checks to see if the priority order index, j, has been exhausted, and if not, returns to step 406 where index j is incremented. If all values of j have been exhausted, step 420 checks to see if B>0, indicating that spare bandwidth is available for distribution in accordance with protocol 800 referenced in step 422. Otherwise, the process terminates.

Detailed Description Text (94):
FIG. 14(b) is a flow diagram for the spare bandwidth allocation process 800 which is initiated by setting the spare bandwidth priority index so that k=1. In step 802, the traffic class index, i, is set equal to the value of k. Step 804 checks boolean flag Q.sub.i to see if data is present, and if so, proceeds to step 806 where the credit, C.sub.i, is checked. If C.sub.i =1, then the i.sup.th class is serviced in step 808 and the excess bandwidth index B is decremented in step 810. Step 812 checks if any excess bandwidth remains and, if not, the process ends. If excess bandwidth is not exhausted, or if Q.sub.i =0 or C.sub.i =0, the process moves to step 814 where index k is incremented. Step 816 checks the value of index k: if k is less than 3, the process returns to step 802; if 3.ltoreq.k.ltoreq.6, then the process proceeds to step 818; and if k=6, the process moves to step 822.

Detailed Description Text (95):
If 3.ltoreq.k<6, then one of three possible and equal priority queues may be serviced. In order to ensure fair and equal distribution of excess bandwidth to voice (i=3), bursty (i=4), or multicast (i=5) data, steps 818 and 820 service these

three round-robin by incrementing index n (mod 3) in step 818 and setting i=3+n in step 820. The process then proceeds back to step 804. When the process ends because all excess bandwidth has been allocated, index n remains set at its last value. The next time that excess bandwidth obtains after class i=1 and i=2 have been serviced, index n picks up the next round-robin value in step 818.

Detailed Description Text (96):
If the test in step 816 indicates that k=6, all five classes have been serviced. Step 822 tests to see if excess bandwidth still exists and if so, repeats the sequence by initializing the priority index so that k=1 and then proceeds to step 802. Otherwise, the process ends.

Detailed Description Text (97):
The order of allocating spare bandwidth described causes the impact of heavy high priority traffic to be born primarily by bursty data, multicast data and voice data. Correspondingly, low-speed statistical data and high speed statistical are less affected by periods of heavy high priority data.

Detailed Description Text (98):
The described method of allocating spare bandwidth between various traffic classes by TXR 56 is an open-loop control system because the data rate is controlled by the sending node without any feedback from the cell switching network. This procedure leads to a conservative allocation of network resources because each terminal network node acts independently and without specific knowledge of the traffic state of the network. In order to achieve higher bandwidth utilization by bursty traffic, without undo congestion on a given virtual connection, it is necessary to provided the ICA feedback information about the level of bursty traffic being handled by all FRPs involved with a given virtual connection.

Detailed Description Text (99):
ICA is configurable on a per connection basis. The configurable MIR and PIR guarantee that each connection gets at least its minimum allocated bandwidth, independent of other traffic.

Detailed Description Text (145):
FIG. 16 is a flow diagram that describes the per virtual connection rate (bandwith) change process 500 by which data rate changes imposed on cell transmitter 220 are adjusted by frame receive controller 201. At step 500, the i.sup.th bursty channel bandwidth, Ni, is initialized by setting the transmission rate to the quiescent rate, QIR.sub.i. Step 504 checks to see if the queue has been inactive for a period of time greater than T.sub.Q, a prescribed configuration parameter. But because the channel has just been activated, the process passes on to step 507. Otherwise, it would go to step 506 where the quiescent rate, QIR.sub.i, is assigned. If no rate change has been received, test step 507 moves the process back to step 504, forming a wait loop. If a rate change moves the process to step 508 where it is determined if it is a rate increase or decrease.

Detailed Description Text (148):
The credit manager function, resident in cell transmitter 220 determines cell receiver 210's per channel output rate by assigning credits in accordance with the state of congestion and data availability. In the four V.35 port embodiment, each channel is serviced round-robin. The relative priority given to each (up to 252) virtual connections is determined by the bandwidth assignment algorithm in conjunction with the credit manager servicing algorithm as shown in the flow diagram of FIG. 17.

Detailed Description Text (149):
Step 600 initializes the credit process by setting the ith virtual circuit (VC) connection's credit, Ti, equal to Di, where Di=N/Ni or the number of tick intervals, T, that must elapse for VC connection i to acquire access to the cell

network. Thus, Di is derived from the current value of Ni generated by bandwidth assignment process 500. Step 602 sets the VC index i=1. The corresponding ith interval, Ti, is decremented by one tick interval, T, in step 604. Test step 606 checks to see if the resulting value of Ti is equal to or less than zero, indicating that a credit should not be added to the i.sup.th credit index, Ci, and if so, passes on to step 616, where the round-robin procedure is initiated by incrementing index i. Otherwise, step 608 is invoked by crediting (incrementing) Ci. Step 610 checks if the incremented value of Ci exceeds the upper limit, Cmax, and if so, moves to step 612 where Ci is set equal to Cmax. The process moves on to step 614. Step 614 restores a positive non-zero value to Ti by adding Di to the value obtained from step 604. (In this manner, non-integer values of Ti are accommodated without the loss in precision that would result if Ti were to be rounded to the nearest integer value.) Step 616 leads to test step 618 to see if all of the VC connections have been served, and if so, a wait of one tick period, T, is imposed by step 620 before repeating the process by returning to step 602. Otherwise, the process returns to step 604.

Detailed Description Paragraph Table (1):
TABLE 1 Class Spare Traffic Number Service Bandwidth Name i Order*, j Priority, k High Priority 0 First X High Speed 1 * 1 Deterministic Low Speed 2 * 2 Statistical Voice 3 * (3)** Bursty 4 * (4)** Multicast 5 * (5)** *Service order determined by minimum configured bandwidth. **Spare bandwidth priority for classes i = 3, 4, and 5 are equal.